

AD719184
16 April 1969

Materiel Test Procedure 10-2-100
General Equipment Test Activity

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY ENGINEERING TEST PROCEDURE

PRESERVATION AND PACKAGING EQUIPMENT

1. OBJECTIVE

This document provides test methods and techniques necessary to determine the technical performance and safety characteristics of preservation and packaging equipment, as described in Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's), and Military and/or Technical Characteristics (MC's and/or TC's), and to determine the test item's suitability for service tests.

2. BACKGROUND

Requirements exist for equipment for use in the preservation, packaging, and packing of supplies and equipment by the Department of the Army in the continental United States and in overseas commands. Many of the equipment items that are employed in preserving and packaging operations have other primary utilizations; some of these item categories are: general hand tools and machines; general shop tools and machines; carpentry tools; compressor equipment; chain hoists; conveyors; and general equipment items, such as brushes and tape dispensers.

There are two general types of preservation and packaging equipment; manual and power operated. Some of the manually-operated items are not hand-held; among these are gasoline or kerosene dispensing pumps, weighing scales, and hand-operated stencil-cutting machines. The hand-held manually-operated items include steel strapping stretchers and sealers, staple-tackers, and wire-tying machines. The power-driven equipment items are either electrically or pneumatically powered. The electrically-powered equipment includes such items as shaker-type paint agitators, baling presses, vacuum cleaners, infrared driers, saw blade filing machines, revolving shaft liquid mixers, electrical stencil-cutting machines, and carton stitching machines. The pneumatically-powered equipment includes blast cleaning cabinets, spark plug cleaners, portable pneumatic hammers, pneumatic oil gun sprayers, heat sealing machines, and paint spray guns. Some pneumatic equipment items are equipped with their own compressors, powered by either electrical motors or gasoline engines.

Although preservation and packaging equipment items are usually employed indoors, where they are not subject to environmental extremes or to varying weather conditions, they must however, be packed in water-and-humidity-proof containers for transport and storage and capable of withstanding extreme temperature conditions and high humidity during storage and transport.

3. REQUIRED EQUIPMENT

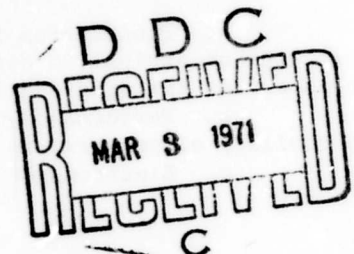
- a. Scales.
- b. Measuring Tape.
- c. Pressure Gages.

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- d. Dynamometer.
- e. Industrial Analyzer.
- f. Flowmeter (air flow).
- g. Vacuum Gage.
- h. Stroboscope.
- i. Air Compressor and Pump with Regulated Output.
- j. Vibration Testing Facility.
- k. 220 volt, 3-phase, 4 wire, 60 Hz electrical power source.
- l. 110 volt, single phase, 3 wire 60 Hz electrical power source.
- m. Leak Detector Solution.
- n. Environmental Test Chambers (-65°F to + 160°F, to 95% R.H.).
- o. Facilities and Equipment, as required by the individual referenced

MTP's and test methods.

4. REFERENCES

- A. USATECOM Regulation 385-6, Safety Release.
- B. USATECOM Regulation 700-1, Value Engineering.
- C. USATECOM Regulation 705-4, Equipment Performance Report.
- D. USAGETA, Human Factors Evaluation Data for General Equipment.
- E. FED-STD-101a, Preservation, Packaging, and Packing Materials: Test Procedures.
- F. FED-STD-151, Metals, Test Methods.
- G. MIL-P-116E, Preservation, Methods of.
- H. MIL-STD-129, Marking for Shipment & Storage.
- I. SB38-100, Preservation, Packaging, and Packing Materials, Supplies, and Equipment Used by the Army.
- J. MIL-T-43121, Interference Reduction for Electric Hand Tools.
- K. MIL-STD-810B, Environmental Test Methods.
- L. MTP 2-2-613, Broadband Radio Interference Testing for Vehicles and Electrical Equipment-Noncommunication.
- M. MTP 10-2-500, Physical Characteristics.
- N. MTP 10-2-501, Operator Training and Familiarization.
- O. MTP 10-2-503, Transportability.
- P. MTP 10-2-505, Human Factors Evaluation.
- Q. MTP 10-2-507, Maintenance Evaluation.
- R. MTP 10-2-508, Safety.

5. SCOPE

5.1 SUMMARY

These procedures describe the preparation for, and the methods of, evaluating the technical performance characteristics of preservation and packaging equipment, in the sequence listed below:

- a. Preparation for Test - A determination of the condition of the test item on arrival, a determination of the test item's physical characteristics, and operator training and familiarization procedures.
- b. Performance - A determination of the efficiency and functional suitability of preservation and packaging equipment.
- c. Electromagnetic compatibility - An evaluation of the electromag-

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netic interference generated by the test item.

d. Environmental Storage - An evaluation to determine whether the test item can withstand storage under extreme conditions of heat, cold, and humidity.

e. Transportability - A determination of the capability of the test item to withstand the shock and vibration encountered during normal handling and transport operations.

f. Maintainability and Reliability Evaluation - That portion of the test which is concerned with the following: Verification and appraisal of failures; determination and appraisal of maintenance characteristics and requirements; appraisal of design-for-maintainability; appraisal of the maintenance test package; and, calculation of indicators which express the effects of the preceding aspects.

g. Human Factors Evaluation - An evaluation of the man-item relationship during installation, operation, maintenance, and transport of the test item, to include adequacy of controls, operability and accessibility design deficiencies, and transportability.

h. Safety - An evaluation of the safety characteristics of the test item.

i. Value Analysis - A determination of the test item's unnecessary, costly, or "nice-to-have" features.

5.2 LIMITATIONS

This MTP is concerned with only that equipment whose primary, or only application is in the performance of preservation and/or packaging operations. This MTP does not contain the testing procedures for other equipment, such as general hand and shop tools and machines, carpentry tools, compressor equipment, chain hoists, conveyors, and general equipment items. Detailed engineering test procedures for these items may be found in the following MTP's:

- a. Conveyor, Roller, Gravity, 9-2-047
- b. Engine, Gasoline, 9-2-102
- c. Motors, Electrical, 9-2-155
- d. Pneumatic Tool Compressor Equipment, 9-2-165
- e. Air Compressor, 9-2-166
- f. Shop Equipment, 9-2-200
- g. Chain Hoists, 9-2-202
- h. Tool Sets, 9-2-212

Because of the wide variety of items that are contained in the general classification of preservation and packaging equipment, this MTP contains tests for efficiency and functional suitability, since these two characteristics provide an overall measure of the item's performance. Additional tests may be required to verify additional performance characteristics of a specific piece of equipment.

6. PROCEDURES

NOTE: During equipment setup and operation, the operating techniques provided in the draft technical manuals shall be followed. Any change or deviation from these instructions shall be recorded in the test item logbooks.

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6.1 PREPARATION FOR TEST

6.1.1 Pre-Test Inspection

On receipt of the test item package(s), the test item shall be subjected to the following procedures:

a. Visually check test item packaging and record the following:

- 1) Evidence of damage or deterioration
- 2) Identification marking including:
 - a) Manufacturer
 - b) Number and date of contract
 - c) Date of manufacture
 - d) Type of equipment

b. Weigh and measure the test item package(s), and record the following:

- 1) For each shipping package:
 - a) Contents
 - b) Weight
 - c) Length, Width, and Height
 - d) Cubage
- 2) For entire test package (if more than one shipping package):
 - a) Total Weight
 - b) Total Cubage

c. Unpack the test item and record the type and adequacy of packing material in the shipping container.

NOTE: Remove any protective material and preservative from the test item (if applicable) using the appropriate solvent when required.

d. Visually inspect the test item, and record the following:

NOTE: Ensure that all surfaces and hardware are free from corrosion, roughness, irregularities and other defects.

- 1) Any evidence of defects in:
 - a) Manufacturing
 - b) Material
 - c) Workmanship
- 2) Evidence of damage and/or wear
- 3) Existence of shortages in test package

4) Deviations in marking from MIL-STD-129

e. Record the presence of plates, if applicable including:

- 1) Identification plates: Name and serial number/model number
- 2) Caution instructions plates
- 3) Service and handling instructions plates

6.1.2 Physical Characteristics

Determine and record the physical characteristics of each test item as described in the applicable sections of MTP 10-2-500 including the following:

- a. Height and Width, or Diameter, as applicable
- b. Length
- c. Weight
- d. Deviations from specifications

6.1.3 Operator Training and Familiarization

a. Ensure the availability of test personnel who have been trained in accordance with the applicable procedures of MTP 10-2-501 and are familiar with the following:

- 1) Test objectives and procedures
- 2) Operational performance
- 3) Maintenance
- 4) Transportability
- 5) Safety
- 6) Human Factors
- 7) Value Analysis

NOTE: Test personnel shall be issued copies of the draft technical manuals, pertinent safety instructions, and the maintenance packages, and the equipment, all of which shall be returned at the completion of testing.

- b. Record the adequacy of the training program.
- c. Record the adequacy of the technical manuals for training purposes.
- d. Record test personnel data as described in MTP 10-2-501.

6.1.4 Test Item Preparation

Prepare the test item for test in accordance with the manufacturer's instructions or the draft technical manual.

6.2 TEST CONDUCT

NOTE: All equipment failures shall be reported in accordance with USATECOM Regulation 705-4.

6.2.1 Performance

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Evaluate the test item performance by performing the following sub-tests, as applicable.

6.2.1.1 Efficiency

- a. Operate the test item as specified.
- b. Measure and record the following for each test item, as applicable:

- 1) Input power
- 2) Output power

NOTE: Power may be mechanical, electrical, hydraulic, or pneumatic. The output will perform one of the following: Propel, draw in, rotate, compress, or pull.

- c. Repeat the procedure until a minimum of three test items have undergone testing.

6.2.1.2 Functional Suitability

- a. Operate the test item through a complete functional cycle working each of its principal components, controls, valves, switches and other working parts necessary to observe the functional suitability of the test item.

- b. Record the following for each test item:

- 1) Description of the function cycle
- 2) Components and other parts operated
- 3) Evaluation of the test item capability to perform the task(s)
- 4) Description and probable cause of any failures

- c. Repeat the procedures until a minimum of three test items have undergone testing.

6.2.1.3 Leakage

Perform the following on test items which use pressure for operation:

- a. Seal the test item outlet and apply air pressure, at the pressure specified, to the inlet.

- b. Paint the test item joints, fittings, castings, etc. with an appropriate leak detecting solution.

- c. Observe and record any evidence of leakage.

- d. Repeat the procedure until a minimum of three test items have undergone leak testing.

6.2.2 Electromagnetic Compatibility

Determine the electromagnetic compatibility of the test item as described in the applicable sections of MTP 2-2-613 or MIL-I-43121 as applicable under the following conditions:

NOTE: MTP 2-2-613 is applicable to all equipment except electric hand tools.

- a. Equipment shall be operated in ambient temperatures above 60°F.
- b. The test item shall be lubricated as described in the applicable lubrication order.
- c. The test item shall be operated normally.

6.2.3 Environmental Storage

Record the following for each test performed:

- a. For each test item:
 - 1) Nomenclature
 - 2) Model number
 - 3) Serial number
- b. For each storage condition:
 - 1) Test temperature
 - 2) Relative humidity
 - 3) Time to return to normal operating conditions

6.2.3.1 High Temperature Storage

- a. Subject a minimum of two test items to the applicable procedures of MIL-STD-810B, Method 501.
- b. Perform the following upon completion of the storage:
 - 1) Visually examine the test item and record any damage or deterioration noted.
 - 2) If applicable, disassemble $\frac{1}{2}$ the test items and record any damage or deterioration to the test item or test item components.
 - 3) Subject the remaining test items to the applicable procedures of paragraph 6.2.1.

6.2.3.2 Low Temperature Storage

- a. Subject a minimum of two test items to the applicable procedures of MIL-STD-810B, Method 502.
- b. At the completion of the procedure of step a repeat the procedures of paragraph 6.2.3.1.b.

6.2.3.2 Humidity Test

- a. Subject a minimum of two test items to the applicable procedures of MIL-STD-810B, Method 507.
- b. At the completion of the procedure of step a repeat the procedures of paragraph 6.2.3.1.b.

6.2.4 Transportability

- a. Subject a minimum of two test items to each of the applicable procedures of MTP 10-2-503.
- b. At the completion of each procedure perform the following:
 - 1) Visually inspect the test item for damage, cracks, breaks, ruptures, etc.
 - 2) Check all fittings for snug fits and record any discrepancies, if applicable.
 - 3) Subject the test item to the performance tests of paragraph 6.2.1, as applicable, to determine if the test item has lost efficiency or become subject to leaks.

6.2.4.1 Vibration Tests

- a. Visually inspect the test item to ensure that it is free of defects.
- b. Pack the test item in its shipping container (may be multiple packed).
- c. The test item shall be given a vibration test as outlined in Federal Test Method Standard 101a, Method 279:
 - 1) For the first 15 minutes, maintain the amplitude constant at $1/2 \pm 1/32$ inch ($1 \pm 1/16$ inch double amplitude); and either vary the frequency to repeatedly sweep at 2 minutes per octave from 2 to 5 cps and return, or maintain for 5 minutes each at constant frequencies of 2, 3, and 5 cps.
 - 2) For the last 105 minutes, maintain the relationship between frequency and amplitude shown in Figure 1, as the frequency is progressively changed from 5 cps to the maximum and returned. The maximum frequency shall be determined on the basis of test item weight as per Figure 2. For apparatus in which the frequency and the amplitude may be varied continuously, sweep the frequency at not less than 2 minutes per octave.
 - 3) For apparatus in which the amplitude may be varied only in increments, the amplitudes of the platform motion, frequencies, and durations shall be as listed in Figure 3.
- d. At completion of the vibration test, repeat the procedures of paragraph 6.2.4.b.

6.2.5 Maintainability and Reliability Evaluation

Evaluate the maintenance-related factors of the test item as described in MTP 10-3-504 with emphasis on the following:

- a. Organizational (O), Direct Support (F), and General Support (H) Maintenance Requirements.
- b. Operator through General Support Maintenance Literature.

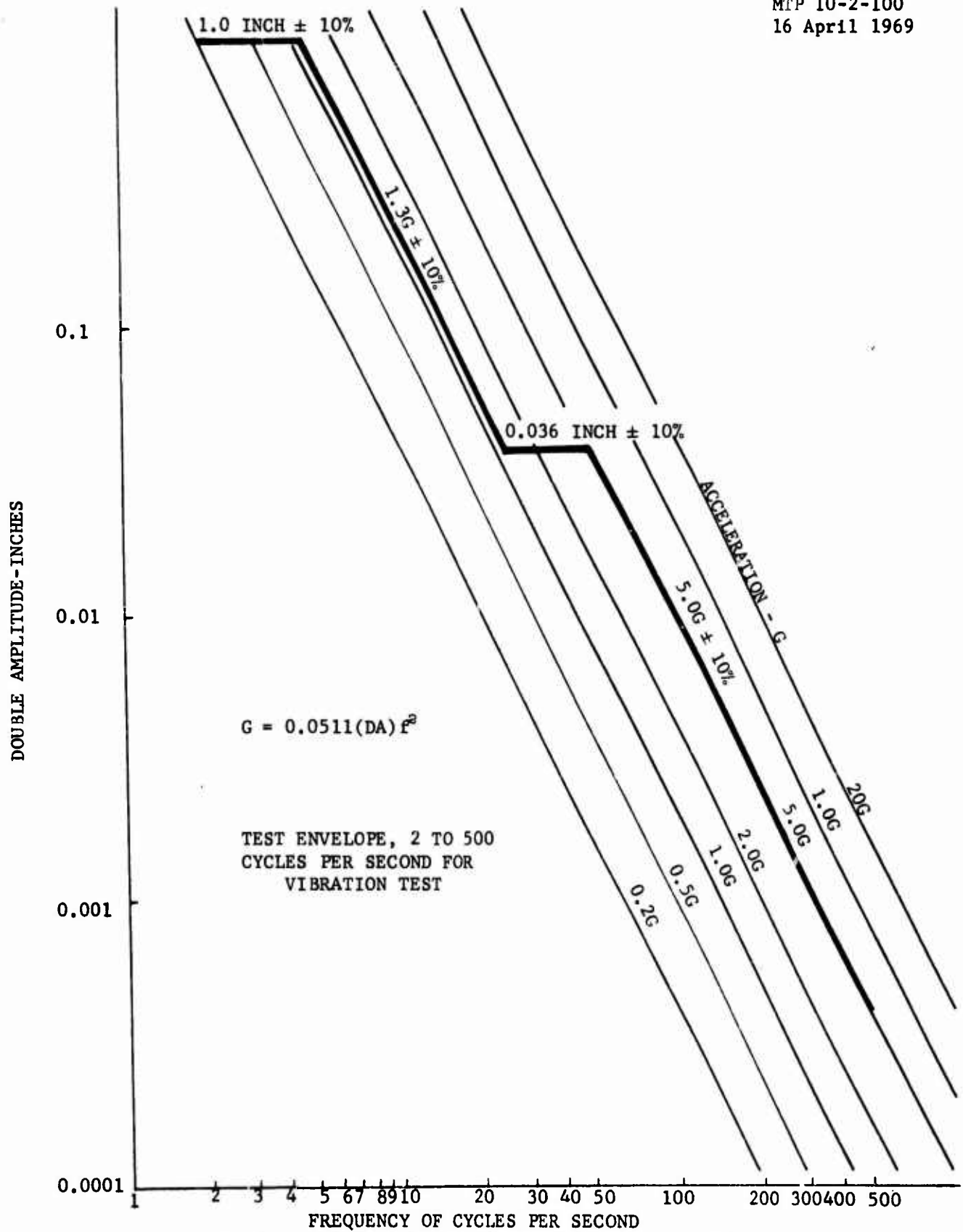


FIGURE 1. FREQUENCY AND AMPLITUDE RELATIONSHIP

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WEIGHT OF SPECIMEN	MAXIMUM FREQUENCY
LB	HERTZ
100 or less	500
300 or more	50
Between 100 and 300	$725 - (2.25 \times \text{weight})$

FIGURE 2. FREQUENCY/WEIGHT CORRELATION

DOUBLE AMPLITUDE CONSTANT	FREQUENCY (f), either		MINIMUM DURATION OF VIBRATION
	SWEEP BETWEEN $f/1.23$ and $1.23f$	CONSTANT	
INCHES	HERTZ	HERTZ	SECONDS
0.673	5.0 to 7.56	6.15	70
.295	7.56 to 11.44	9.30	70
.129	11.44 to 17.30	14.07	70
.055	17.30 to 26.6	21.60	70
.036		32.70	70
.036		49.50	35
.036	26.6 to 50.0		105
.036	50.0 to 26.6		105
.036		49.50	35
.036		32.70	70
.055	26.6 to 17.30	21.60	70
.129	17.30 to 11.44	14.07	70
.295	11.44 to 7.56	9.30	70
.673	7.56 to 5.0	6.15	70

Either use the constant frequency or, preferably, sweep the range of frequency at not less than 2 minutes per octave.

FIGURE 3. FREQUENCY/AMPLITUDE/DURATION CORRELATION

- c. Repair parts.
- d. Tools.
- e. Test and handling equipment.
- f. Calibration and maintenance facilities.
- g. Personnel skill requirements.
- h. Maintainability.
- i. Reliability.
- j. Availability.

6.2.6 Human Factors Evaluation

NOTE: Develop and employ a systematic method of observational and interview data collection, including the construction of a task/component checklist. This checklist may be developed from Human Factors Evaluation Data for General Equipment (HEDGE), shall briefly describe each task to be performed and the related component involved, and shall provide the following checkspaces for each human factors consideration of each task:

- a. Satisfactory _____
- b. Unsatisfactory _____
- c. N/A _____
- d. Comments _____

Determine the adequacy of the design and performance characteristics of the item and its associated equipment in terms of conformance to appropriate human factors engineering design criteria as described in the applicable portions of MTP 10-2-505 and by evaluating the following:

- a. Ease of operating test item.
- b. Accessibility of controls and visibility of indicators.
- c. Adequacy of instruction markings.
- d. Determination and evaluation of the tendency of any protrusions, sharp edges, or moving parts to snag or cut clothing of user or passerby or to damage packaging container or materials.
- e. Acceptability of sound level of operating test item.
- f. Balance and maneuverability of hand-held type test item.
- g. Transportability characteristics.

6.2.7 Safety

a. Testing personnel shall comply at all times with the safety regulations governing the operation of all test items and test equipment. In addition, testing personnel shall note and record the following:

- 1) Dangerous or unsafe conditions resulting from inadequate features.

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- 2) Dangerous or unsafe features on test item.
- 3) Safety features of the test item.
- 4) Suggestions to improve existing safety precautions.

b. A safety release shall be issued in accordance with USATECOM Regulation 385-6.

6.2.8 Value Analysis

Value analysis shall be performed to determine whether the test item has any nonfunctional, costly, or "nice-to-have" features as stated in USATECOM Regulation 700-1.

a. During operation and maintenance of the test item, observations shall be made to determine whether it incorporates any features that could be eliminated without compromising its performance, reliability, durability, maintainability, or safety.

b. During conduct of the test, testing personnel shall be informally questioned regarding any features of the test item that may be eliminated without decreasing its functional value. All user comments regarding value analysis shall be recorded in the daily log.

c. Each test team member shall study the test item during use, and shall draw on his experience and background in value analysis to comment in the daily log regarding elimination of unnecessary features.

6.3 TEST DATA

6.3.1 Preparation for Test

6.3.1.1 Pre-Test Inspection

Record the following:

- a. Evidence of package damage or deterioration
- b. Identification markings including:

- 1) Manufacturer
- 2) Number and date of contract
- 3) Date of manufacture
- 4) Type of equipment

- c. For each shipping package

- 1) Contents
- 2) Weight, in pounds
- 3) Overall dimensions, in feet and inches, of:

- a) Length
- b) Width
- c) Height
- 4) Cubage, in cubic feet
- d. For entire test item package (if more than one shipping package):
 - 1) Weight, in pounds
 - 2) Cubage, in cubic feet
- e. Type and adequacy of packing material
- f. Defects in:
 - 1) Manufacturing
 - 2) Material
 - 3) Workmanship
- g. Evidence of damage and/or wear
- h. Existence of shortages
- i. Deviations in marking from MIL-STD-129
- j. Presence of, as applicable:
 - 1) Identification plates
 - 2) Caution instructions plates
 - 3) Service and handling instructions plates

6.3.1.2 Physical Characteristics

Record data collected as described in the applicable sections of MTP 10-2-500 and the following:

- a. Test item length and width, or diameter in feet and inches
- b. Test item height in feet and inches
- c. Test item weight in pounds
- d. Deviations from specifications

6.3.1.3 Operator Training and Familiarization

- a. The adequacy of training
- b. Adequacy of the technical manual for training purposes
- c. Service test personnel data as described in MTP 10-2-501

6.3.2 Test Conduct

6.3.2.1 Performance

Record the following for each test item undergoing performance evaluation:

- a. Nomenclature

- b. Model number
- c. Serial number

6.3.2.1.1 Efficiency -

Record the following:

- a. Input power, in applicable units
- b. Output power, in applicable units

NOTE: When applicable, convert input or output power measurements into compatible units.

6.3.2.1.2 Functional Suitability -

Record the following for each test item:

- a. Description of the function cycle
- b. Components and other parts operated (valves, switches, etc)
- c. Evaluation of the test item capability to perform the task(s)
- d. Description and probable cause of any failures

6.3.2.1.3 Leakage -

Record the following for each test item:

- a. Test pressure in psi
- b. Any evidence of test item or component leakage

6.3.2.2 Electromagnetic Compatibility

Record electromagnetic compatibility data as described in the applicable sections of MTP 2-2-613 or MIL-I-43121, as applicable.

6.3.2.3 Environmental Storage

Record the following for each test item undergoing environmental storage tests:

- a. Nomenclature.
- b. Model number.
- c. Serial number.
- d. Storage test performed (high temperature, low temperature, etc).
- e. Test temperature used, in °F.
- f. Relative humidity, in percent.
- g. Time to return to normal operating conditions.
- h. Any damage or deterioration to test item or test item components due to storage.
- i. Performance data, collected as described in the applicable sections of 6.2.1.

6.3.2.4 Transportability

Record the following for each test performed:

- a. Data collected as described in the applicable sections of MTP 10-2-503.
- b. Vibration test data collected as described in Federal Test Method Standard 101a, Method 279.
- c. Evidence of damage, cracks, leaks, ruptures, loose fittings, etc.
- d. Performance data collected as described in the appropriate sections of paragraph 6.2.1 at the completion of each transportability test.

6.3.2.5 Maintenance Evaluation

Record the following:

- a. Data collected as described in the applicable sections of MTP 10-2-507.
- b. Adequacy of the manufacturer's:
 - 1) Technical instructions
 - 2) Maintenance instructions
 - 3) Draft technical manuals
- c. Degree of maintainability designed into the test item.
- d. Effectiveness of repair-by-replacement type and maintenance free components.
- e. Mean time to repair the test item in minutes.
- f. Minimum allowable time between scheduled maintenance actions.
- g. Time required for:
 - 1) Organizational maintenance
 - 2) Higher echelon maintenance (DS or GS)

6.3.2.6 Human Factors Evaluation

Record data, collected as described in the applicable sections of MTP 10-2-505, and the following, as applicable:

- a. Ease of operating test item.
- b. Accessibility of controls and visibility of indicators.
- c. Adequacy of instruction markings.
- d. Any tendencies of any protrusions, sharp edges, or moving parts to snag or cut clothing of user or passerby or to damage packaging containers or materials.
- e. Acceptability of sound level of operating test item.
- f. Balance and maneuverability of hand-held-type test item.
- g. Transportability characteristics.

6.3.2.7 Safety

Record the following throughout the test:

- a. Normal safety precautions taken during testing procedures and use and handling of test item.
- b. Any dangerous or unsafe condition resulting from inadequate features.
- c. Any dangerous or unsafe features on test item.
- d. Any safety features on test item.
- e. Suggestions to improve existing safety precautions.

6.3.2.8 Value Analysis

Record the following throughout the test:

- a. Nonfunctional or unnecessary features
- b. Test personnel comments

6.4 DATA REDUCTION AND PRESENTATION

Data obtained during the conduct of the tests shall be summarized, making use of photographs and charts as appropriate. Test data for each equipment item tested shall be obtained, summarized, and evaluated as required.

Data obtained for each performance characteristic shall be compared with technical performance characteristics specified in the QMR's, SDR's, or other developmental criteria. Test data obtained from different types of preservation and packaging equipment undergoing the same test shall be compared.

Calculate the efficiency of the test item from the input and output power data collected in paragraph 6.2.1.2.

In addition to charts and photographs, presentation shall include narrative reports on all phases of the test.

In all cases where a performance test is repeated after a specific exposure to an alien environment, the data obtained shall be compared with the previously obtained performance data and, where definite differences occur, the conditions that caused the differences shall be summarized along with the appropriate comments by test personnel.

A Safety Release, in accordance with USATECOM Regulation 385-6 shall be issued, based on the data collected under paragraph 6.3.2.

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	JUSTIFICATION				
BY	AUTHORITY/AVAILABILITY CODES				
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